

REMARKS

Pending Claims

Claims 1-30 are pending in the present application. Claims 1, 13, 17, 24, and 27 have been amended in order to more clearly describe Applicant's invention. No new matter has been added.

Summary of the Invention

The present invention relates to ink compositions comprising a liquid vehicle, at least one modified pigment comprising a pigment having attached at least one functional group, at least one salt having a polyvalent ion, and at least one polymer.

The present invention relates to ink compositions comprising a liquid vehicle, at least one modified pigment comprising a pigment having attached at least one functional group, at least one salt having a polyvalent ion, and at least one polymer. The polyvalent ion can be cationic or anionic and is preferably capable of coordinating or associating with the functional group of the pigment, the polymer, or both. A method of generating an image comprising the steps of incorporating into a printing apparatus the ink composition described above and generating an image onto a substrate is also disclosed.

Rejection of Claims under 35 U.S.C. § 112, Second Paragraph

Claim 13

The Examiner has rejected the above-identified claim as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

In paragraph 2 of the Office Action, the Examiner states that claim 13 recites specific types of pigments and "shades thereof" and that the scope of this claim is confusing because it is not clear what is meant by "shades thereof".

Applicant believes that this phrase is clear to one skilled in the art of colored pigments and would understand that this refers to the pigments having shades of the colors of the pigments listed. However, in order to more clearly described Applicant's invention, claim 13 has been amended to recite a pigment having a white shade, a black shade, a blue shade, a brown shade, a cyan shade, a green shade, a violet shade, a magenta shade, a red shade, or a yellow shade and the phrase "shades thereof" has been removed.

Therefore, Applicant believes that claim 13 is not indefinite and respectfully requests that the rejection of this claim be withdrawn.

Claims 17 and 24

The Examiner has rejected the above-identified claims as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

In paragraph 2 of the Office Action, the Examiner states that these claims appear to recite an improper Markush group and suggests that the word "list" be replaced by the word "group." Applicant has amended claims 17 and 24 as suggested by the Examiner, and therefore respectfully requests that the rejection of these claims be withdrawn.

Rejection of Claims under 35 U.S.C. § 102(e)

Claims 1-2, 4-13, 20, 25-28, and 30

The Examiner has rejected the above-identified claims as being anticipated by Komatsu et al. (U.S. Patent No. 6,379,443). Applicant respectfully disagrees.

In paragraph 4 of the Office Action, the Examiner states that Komatsu et al. discloses ink jet inks comprising an aqueous liquid vehicle, a modified pigment comprising a pigment such as

carbon black and cyan, magenta, and yellow pigments, having attached functional groups including sulfonate and carboxyl groups as well as polymeric groups (polymers such as styrene-(meth)acrylate copolymer), and a salt having polyvalent metal anions such as phosphate and carbonate. The Examiner further states that a method wherein the above ink is incorporated into an ink jet printer and then printed onto a substrate is also disclosed. The Examiner concludes that, although there is no disclosure that the functional group present on the pigment is capable of coordinating with the polyvalent ion, given that Komatsu et al. discloses salts comprising a polyvalent ion identical to that presently claimed and pigment having attached functional groups identical to that presently claimed, it is clear that the functional group of the pigment is inherently capable of coordinating with the polyvalent ion and therefore anticipates the present claims.

Regarding claims 1-2, 4-13, 20, and 25-26, claim 1 as amended relates to an ink composition comprising a) a liquid vehicle, b) at least one modified pigment comprising a pigment having attached at least one functional group, c) at least one salt having a polyvalent ion, and d) at least one polymer. The functional group is capable of coordinating with the polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion.

Komatsu et al. discloses an ink composition for an ink jet recording method in which the ink composition comprises a water soluble organic solvent, water, a dispersed colorant, and specified materials having an ethyleneoxide and a propyleneoxide group. The colorant may be dispersed with the aid of a dispersant or may be a colorant having a functional group introduced onto its surface. In a preferred embodiment, the functional group is a sulfur-containing group such as a sulfinic acid or sulfonic acid group. Additionally, Komatsu et al. discloses that, if necessary, certain pH adjustors, solubilizers, and antioxidants may be added, some of which are salts having polyvalent anions.

However, unlike the present invention, Komatsu et al. does not disclose an ink composition comprising a pigment having attached at least one functional group wherein the functional group is capable of coordinating with the polyvalent ion of the salt. The Examiner has concluded that, since the ink composition of Komatsu et al. comprises a colorant having a

functional group and a salt having a polyvalent ion, that these components would therefore inherently be capable of coordination. However, according to the disclosure of Komatsu et al, coordination is not a necessary and inevitable consequence of combining the salt and the colorant. For example, the preferred colorants of Komatsu et al. have sulfinic acid, sulfonic acid, carboxylic acid, or hydroxyl surface groups (see column 6, lines 50-54). These functional groups are anionic in nature when providing dispersibility. The salts disclosed in column 10, lines 11-12, which was cited by the Examiner, are salts having polyvalent anions. Thus, an anionic functional group is used in combination with a salt having a polyvalent anion, and one skilled in the art would not expect this functional group to coordinate or associate with this type of salt. Polyvalent cations are not disclosed in Komatsu et al. Therefore, contrary to the Examiner's statement, the functional groups of the colorants of Komatsu et al. would not inherently be capable of coordinating with the polyvalent ion of the added salts.

Furthermore, claim 1 recites that the functional group is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion. Thus, as described in paragraph [0045] of the present application, a polyvalent cation is used in combination with a modified pigment having attached at least one anionic group or a polyvalent anion is used in combination with a modified pigment having attached at least one cationic group. Komatsu et al. does not disclose these specific combinations.

Applicant therefore believes that claim 1 is not anticipated by Komatsu et al. Furthermore, claims 2, 4-13, 20, and 25-26, which depend either directly or indirectly from claim 1, recite further embodiments of the present invention and, for at least the reasons discussed above, are also not anticipated by this reference.

Regarding claims 27-28 and 30, claim 27 as amended relates to a method of generating an image comprising the steps of: 1) incorporating into a printing apparatus an ink composition comprising a liquid vehicle, at least one modified pigment comprising a pigment having attached at least one functional group, at least one salt with a polyvalent ion, and at least one polymer, and 2) generating an image on a substrate, wherein said functional group is capable of coordinating with said polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic

when the salt comprises a polyvalent anion. This claim therefore relates to an image generating method using the ink composition of claim 1. Since Applicant believes Komatsu et al. does not disclose the ink composition of the present invention, this reference therefore cannot disclose the method of generating image of claim 27.

Applicant therefore believes that claim 27 is not anticipated by Komatsu et al. Furthermore, claims 28 and 30, which depend directly from claim 27, recite further embodiments of the present invention and, for at least the reasons discussed above, are also not anticipated by this reference.

Therefore, Applicant believes that claims 1-2, 4-13, 20, 25-28, and 30 are not anticipated by Komatsu et al. and respectfully requests that this rejection be withdrawn.

Claims 1-2, 4-9, 11-13, 20- 25, 27-28, and 30

The Examiner has rejected the above-identified claims as being anticipated by Ichizawa et al. (U.S. Patent No. 6,368, 397). Applicant respectfully disagrees.

In paragraph 5 of the Office Action, the Examiner states that Ichizawa et al. discloses ink jet inks comprising an aqueous liquid vehicle, a modified pigment comprising a pigment such as carbon black and cyan, magenta, and yellow pigments having attached functional groups including sulfonate and carboxyl groups, a polymer such as an acrylic polymer, a styrene-acrylic copolymer, and a (meth)acrylic acid containing polymer, and a salt having a polyvalent metal anion such as phosphate. The Examiner further states that a method wherein the above ink is incorporated into an ink jet printer and then printed onto a substrate is also disclosed. The Examiner concludes that, although there is no disclosure that the functional group present on the pigment or the functional group present on the polymer is capable of coordinating with the polyvalent ion, given that Ichizawa et al. discloses salts comprising a polyvalent ion identical to that presently claimed as well as a pigment having attached functional groups and a polymer comprising functional groups identical to that presently claimed, it is clear that the functional group of either the pigment or polymer is inherently capable of coordinating with the polyvalent ion and therefore anticipates the present claims.

Regarding claims 1-2, 4-9, 11-13, and 20-25, claim 1 relates to an ink composition comprising a) a liquid vehicle, b) at least one modified pigment comprising a pigment having attached at least one functional group, c) at least one salt having a polyvalent ion, and d) at least one polymer. The functional group is capable of coordinating with the polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion.

Ichizawa et al. discloses an ink for ink jet printing which contains as essential components a pigment, a water-soluble organic solvent, and water. Ichizawa et al. describes several types of pigments that can be used, including a pigment that is capable of self-dispersing, such as a hydrophilic pigment. Examples of "hydrophilicized" pigments include surface-modified pigments containing solubilizing groups which are nonionic, cationic, or anionic (see column 7, lines 31-32). Additionally, Ichizawa et al. discloses that, if necessary, the pH of the ink can be adjusted using various salts, some of which are salts having polyvalent anions.

However, unlike the present invention, Ichizawa et al. does not disclose an ink composition comprising a pigment having attached at least one functional group wherein the functional group is capable of coordinating with the polyvalent ion of the salt. The Examiner has concluded that, since the ink composition of Ichizawa et al. comprises a colorant having a functional group and a salt having a polyvalent ion, that these components would therefore inherently be capable of coordination. However, according to the disclosure of Ichizawa et al, coordination is not a necessary and inevitable consequence of combining the salt and the colorant. For example, the preferred colorants of Komatsu et al. have sulfonic acid, carboxylic acid, phosphoric acid, or hydroxyl surface groups (see column 7, lines 32-34). These functional groups are anionic in nature when providing dispersibility. The salts disclosed in column 12, lines 60-61, which was cited by the Examiner, are salts having polyvalent anions. Thus, an anionic functional group is used in combination with a salt having a polyvalent anion, and one skilled in the art would not expect this functional group to coordinate or associate with this type of salt. Polyvalent cations are not disclosed in Ichizawa et al. Therefore, contrary to the

Examiner's statement, the functional groups of the colorants of Ichizawa et al. would not inherently be capable of coordinating with the polyvalent ion of the added salts.

Furthermore, claim 1 recites that the functional group is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion. Thus, as described in paragraph [0045] of the present application, a polyvalent cation is used in combination with a modified pigment having attached at least one anionic group or a polyvalent anion is used in combination with a modified pigment having attached at least one cationic group. Ichizawa et al. does not disclose these specific combinations.

Applicant therefore believes that claim 1 is not anticipated by Ichizawa et al. Furthermore, claims 2, 4-9, 11-13, and 20-25, which depend either directly or indirectly from claim 1, recite further embodiments of the present invention and, for at least the reasons discussed above, are also not anticipated by this reference.

Regarding claims 27-28 and 30, claim 27 as amended relates to a method of generating an image comprising the steps of: 1) incorporating into a printing apparatus an ink composition comprising a liquid vehicle, at least one modified pigment comprising a pigment having attached at least one functional group, at least one salt with a polyvalent ion, and at least one polymer, and 2) generating an image on a substrate, wherein said functional group is capable of coordinating with said polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion. This claim therefore relates to an image generating method using the ink composition of claim 1. Since Applicant believes Ichizawa et al. does not disclose the ink composition of the present invention, this reference therefore cannot disclose the method of generating image of claim 27.

Applicant therefore believes that claim 27 is not anticipated by Ichizawa et al. Furthermore, claims 28 and 30, which depend directly from claim 27, recite further embodiments of the present invention and, for at least the reasons discussed above, are also not anticipated by this reference.

Therefore, Applicant believes that claims 1-2, 4-9, 11-13, 20-25, 27-28, and 30 are not anticipated by Ichizawa et al. and respectfully requests that this rejection be withdrawn.

Claims 1-2, 4-13, 20-28, and 30

The Examiner has rejected the above-identified claims as being anticipated by Suzuki et al. (U.S. Patent No. 6,153,001). Applicant respectfully disagrees.

In paragraph 6 of the Office Action, the Examiner states that Suzuki et al. discloses ink jet inks comprising an aqueous liquid vehicle, a modified pigment comprising a pigment such as carbon black and cyan, magenta, and yellow pigments having attached functional groups including sulfonate and carboxyl groups as well as polymeric groups, a polymer such as polystyrene sulfonate, polyacrylate, and acrylic acid-acrylate copolymer, and a salt having a polyvalent metal anion such as phosphate or oxalate. The Examiner further states that a method wherein the above ink is incorporated into an ink jet printer and then printed onto a substrate is also disclosed. The Examiner concludes that, although there is no disclosure that the functional group present on the pigment or the functional group present on the polymer is capable of coordinating with the polyvalent ion, given that Suzuki et al. discloses salts comprising a polyvalent ion identical to that presently claimed as well as a pigment having attached functional groups and a polymer comprising functional groups identical to that presently claimed, it is clear that the functional group of either the pigment or polymer is inherently capable of coordinating with the polyvalent ion and therefore anticipates the present claims.

Regarding claims 1-2, 4-13, and 20-26, claim 1 relates to an ink composition comprising a) a liquid vehicle, b) at least one modified pigment comprising a pigment having attached at least one functional group, c) at least one salt having a polyvalent ion, and d) at least one polymer. The functional group is capable of coordinating with the polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion.

Suzuki et al. discloses an ink jet recording ink comprising water, an aqueous organic solvent, a surfactant, and a self-dispersing pigment. The self-dispersing pigment is a pigment having a surface functional group such as hydrophilic solubilizing groups which are nonionic, cationic, or anionic (see column 7, lines 35-39). Additionally, Suzuki et al. discloses that, if

necessary, pH regulating agents may be used in the ink composition, some of which are salts having polyvalent anions.

However, unlike the present invention, Suzuki et al. does not disclose an ink composition comprising a pigment having attached at least one functional group wherein the functional group is capable of coordinating with the polyvalent ion of the salt. The Examiner has concluded that, since the ink composition of Suzuki et al. comprises a colorant having a functional group and a salt having a polyvalent ion, that these components would therefore inherently be capable of coordination. However, according to the disclosure of Suzuki et al, coordination is not a necessary and inevitable consequence of combining the salt and the colorant. For example, the preferred colorants of Suzuki et al. have surface groups including carboxylic acid, hydroxyl, sulfonic acid, phosphoric acid, or salts thereof (see column 7, lines 39--52). These functional groups are anionic in nature when providing dispersibility. The salts disclosed in column 13, lines 16, which was cited by the Examiner, are salts having polyvalent anions. Thus, an anionic functional group is used in combination with a salt having a polyvalent anion, and one skilled in the art would not expect this functional group to coordinate or associate with this type of salt. Polyvalent cations are not disclosed in Suzuki et al. Therefore, contrary to the Examiner's statement, the functional groups of the colorants of Suzuki et al. would not inherently be capable of coordinating with the polyvalent ion of the added salts.

Furthermore, claim 1 recites that the functional group is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion. Thus, as described in paragraph [0045] of the present application, a polyvalent cation is used in combination with a modified pigment having attached at least one anionic group or a polyvalent anion is used in combination with a modified pigment having attached at least one cationic group. Suzuki et al. does not disclose these specific combinations.

Applicant therefore believes that claim 1 is not anticipated by Suzuki et al. Furthermore, claims 2, 4-13, and 20-26, which depend either directly or indirectly from claim 1, recite further embodiments of the present invention and, for at least the reasons discussed above, are also not anticipated by this reference.

Regarding claims 27-28 and 30, claim 27 as amended relates to a method of generating an image comprising the steps of: 1) incorporating into a printing apparatus an ink composition comprising a liquid vehicle, at least one modified pigment comprising a pigment having attached at least one functional group, at least one salt with a polyvalent ion, and at least one polymer, and 2) generating an image on a substrate, wherein said functional group is capable of coordinating with said polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion. This claim therefore relates to an image generating method using the ink composition of claim 1. Since Applicant believes Suzuki et al. does not disclose the ink composition of the present invention, this reference therefore cannot disclose the method of generating image of claim 27.

Applicant therefore believes that claim 27 is not anticipated by Suzuki et al. Furthermore, claims 28 and 30, which depend directly from claim 27, recite further embodiments of the present invention and, for at least the reasons discussed above, are also not anticipated by this reference.

Therefore, Applicant believes that claims 1-2, 4-13, 20-28, and 30 are not anticipated by Suzuki et al. and respectfully requests that this rejection be withdrawn.

Rejection of Claims under 35 U.S.C. § 103(a)

Claims 1-2, 4-9, 11-12, 14-25, 27-28, and 30

The Examiner has rejected the above-identified claims as being unpatentable over WO 96/18695 in view of Lin (U.S. Patent No. 5,997,623). Applicant respectfully disagrees.

In paragraph 8 of the Office Action, the Examiner states that WO 96/18965 discloses ink jet inks comprising an aqueous liquid vehicle, a modified pigment such as carbon black having attached functional groups including ionic or ionizable groups such as ammonium, sulfonate, and carboxyl groups, and a polymer such as styrene-acrylic acid copolymer or styrene-maleic acid copolymer. The Examiner further states that a method wherein the above ink is incorporated into an ink jet printer and then printed onto a substrate is also disclosed. The Examiner also states that,

while WO 96/18695 does not disclose the requirement of a salt having a polyvalent ion, Lin, which is drawn to ink jet inks, discloses using salts comprising polyvalent metal cations such as calcium, magnesium, cadmium, copper, aluminum, iron, and zinc as well as polyvalent metal anions such as sulfate in order to reduce intercolor bleed. The Examiner concludes that, although there is no disclosure that either the functional group present on the pigment or the functional group present on the polymer as disclosed in WO 96/18695 is capable of coordinating with the polyvalent ion of the salt as disclosed by Lin, given that WO 96/18695 discloses pigments having attached functional groups and a polymer comprising functional groups identical to that presently claimed and Lin discloses salts comprising polyvalent ions identical to that presently claimed, it is clear that the functional group of the pigment or polymer is intrinsically capable of coordinating with the polyvalent ion. Therefore, in light of the motivation for using a salt disclosed by Lin as described above, the Examiner concludes it would have been obvious to one of ordinary skill in the art to use such a salt in the ink jet ink of WO 96/18695 in order to reduce intercolor bleed and thereby arrive at the claimed invention.

Regarding claims 1-2, 4-9, 11-12, and 14-25, claim 1 relates to an ink composition comprising a) a liquid vehicle, b) at least one modified pigment comprising a pigment having attached at least one functional group, c) at least one salt having a polyvalent ion, and d) at least one polymer. The functional group is capable of coordinating with the polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion.

WO 96/18695 discloses an aqueous ink jet ink comprising an aqueous vehicle and a modified carbon product comprising carbon having attached at least one organic group. The organic group comprises at least one ionic or ionizable group. A variety of additives, including polymers having functional groups, may be added (see page 8, line 13 to page 9, line 27). However, there is no teaching or suggestion of the use of a salt having a polyvalent ion in combination with a polymer and a modified carbon product.

Lin discloses an aqueous ink jet ink comprising water, a colorant such as a dye or a pigment, and a diol derivative having a specified formula. A multi-color ink jet printing process

is also described. Lin further teaches that the ink jet ink may optionally comprise a water soluble or miscible microwave coupler. Various salts for this purpose are disclosed, including salts having polyvalent cations or anions. However, there is no teaching in Lin of an ink composition comprising a modified pigment having attached at least one organic group. Only conventional pigments are disclosed.

Since WO 96/18695 relates to ink compositions comprising modified pigments while Lin does not, Applicant believes that these references would not be combined by one skilled in the art. These references deal with very different types of pigments. Additionally, Lin teaches that the salts having polyvalent ions exhibit a high degree of ionization in aqueous inks and help avoid intercolor bleed when the ink is printed next to, for example, a pigment based ink that is stabilized by an anionic dispersant (column 14, lines 56-62). This is due to the interaction of the disclosed ink, which has the polyvalent ion, and the anionic dispersant of the second ink. Furthermore, Lin teaches that it is desirable for the mult-valent metal salts to be compatible with the components of the ink, including the pigment, and are chosen so that they will not cause latency or jetting problems (column 15, lines 17-24). One skilled in the art, in considering this teaching of Lin, would therefore not use a salt having a polyvalent ion in an ink composition having a modified pigment, as in WO 96/18695, since it would be expected that destabilization of the ink would occur. This is further supported by the disclosure of the present invention (see paragraph [0046]) in which it is described that flocculation of the pigment can result when the salt having a polyvalent ion is added to a modified pigment. The addition of a polymer is then found to redisperse the pigment, but this could only have been learned through hindsight.

Thus, while one skilled in the art may consider using a salt having a polyvalent ion in an ink composition comprising conventional pigments, based on the teaching of Lin, one would not be motivated to use these salts in an ink composition comprising a modified pigment, as taught in WO 96/18695.

Also, claim 1 further recites that the functional group is capable of coordinating with the polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion. There is no teaching in Lin that the polyvalent ion coordinates

with any functional groups, especially any within the same ink composition. Only interactions with other inks are disclosed (for bleed control). Additionally, there is no teaching or suggestion in Lin that specific salts having polyvalent ions should be used in combination with any specific materials. Only with the use of hindsight would one choose to combine a modified pigment having an anionic functional group in combination with a salt having a polyvalent cation or a modified pigment having a cationic functional group in combination with a salt having a polyvalent anion. Therefore, even if these references are combined, the result would not be the ink composition of the present invention.

Applicant therefore believes that claim 1 is patentable over WO 96/18596 in view of Lin. Furthermore, claims 2, 4-9, 11-12, and 14-25, which depend either directly or indirectly from claim 1, recite further embodiments of the present invention and, for at least the reasons discussed above, are also patentable over these references.

Regarding claims 27-28 and 30, claim 27 as amended relates to a method of generating an image comprising the steps of: 1) incorporating into a printing apparatus an ink composition comprising a liquid vehicle, at least one modified pigment comprising a pigment having attached at least one functional group, at least one salt with a polyvalent ion, and at least one polymer, and 2) generating an image on a substrate, wherein said functional group is capable of coordinating with said polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion. This claim therefore relates to an image generating method using the ink composition of claim 1. Since Applicant believes claim 1 is not obvious based on WO 96/18596 in view of Lin, the method of generating image of claim 27 is also not obvious based on these references.

Applicant therefore believes that claim 27 is patentable over WO 96/18596 in view of Lin. Furthermore, claims 28 and 30, which depend directly from claim 27, recite further embodiments of the present invention and, for at least the reasons discussed above, are also patentable over these reference.

Therefore, Applicant believes that claims 1-2, 4-9, 11-12, 14-25, 27-28, and 30 are patentable over WO 96/18596 in view of Lin and respectfully requests that this rejection be withdrawn.

Claims 1-10 and 13-30

The Examiner has rejected the above-identified claims as being unpatentable over Yu et al. (U.S. Patent No. 6,494,943) in view of Lin (U.S. Patent No. 5,997,623). Applicant respectfully disagrees.

In paragraph 9 of the Office Action, the Examiner states that Yu et al. discloses ink jet inks comprising an aqueous or non-aqueous liquid vehicle, a modified pigment comprising pigments such as cyan, magenta, and yellow pigments having attached functional groups including ionic or ionizable groups such as ammonium, sulfonate, and carboxyl groups as well as polymeric groups, and a polymer such as styrene-acrylic acid copolymer or styrene-maleic acid copolymer. The Examiner further states that a method wherein the above ink is incorporated into an ink jet printer and then printed onto a substrate is also disclosed. The Examiner also states that, while Yu et al. does not disclose the requirement of a salt having a polyvalent ion, Lin, which is drawn to ink jet inks, discloses using salts comprising polyvalent metal cations such as calcium, magnesium, cadmium, copper, aluminum, iron, and zinc as well as polyvalent metal anions such as sulfate in order to reduce intercolor bleed. The Examiner concludes that, although there is no disclosure that either the functional group present on the pigment or the functional group present on the polymer as disclosed in Yu et al. is capable of coordinating with the polyvalent ion of the salt as disclosed by Lin, given that Yu et al. discloses pigments having attached functional groups and a polymer comprising functional groups identical to that presently claimed and Lin discloses salts comprising polyvalent ions identical to that presently claimed, it is clear that the functional group of the pigment or polymer is intrinsically capable of coordinating with the polyvalent ion. Therefore, in light of the motivation for using a salt disclosed by Lin as described above, the Examiner concludes it would have been obvious to one of ordinary skill in the art to use such a salt in the ink jet ink of Yu et al. in order to reduce intercolor bleed and thereby arrive at the claimed invention.

Regarding claims 1-10 and 13-26, claim 1 relates to an ink composition comprising a) a liquid vehicle, b) at least one modified pigment comprising a pigment having attached at least one functional group, c) at least one salt having a polyvalent ion, and d) at least one polymer. The functional group is capable of coordinating with the polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion.

Yu et al. discloses an aqueous ink jet ink comprising at least one liquid vehicle and comprising at least one of several disclosed characteristics. The vehicle may be aqueous or non-aqueous, and the ink jet ink may comprise a colored pigment having attached at least one organic group. A variety of organic groups, including ionic or ionizable groups, are disclosed. However, there is no teaching or suggestion of the use of a salt having a polyvalent ion in combination with a polymer and a modified colored pigment.

Lin discloses an aqueous ink jet ink comprising water, a colorant such as a dye or a pigment, and a diol derivative having a specified formula. A multi-color ink jet printing process is also described. Lin further teaches that the ink jet ink may optionally comprise a water soluble or miscible microwave coupler. Various salts for this purpose are disclosed, including salts having polyvalent cations or anions. However, there is no teaching in Lin of an ink composition comprising a modified pigment having attached at least one organic group. Only conventional pigments are disclosed.

Therefore, Yu et al. relates to ink compositions comprising colored pigments including modified colored pigments while Lin only relates to conventional pigments. Therefore, Applicant believes that, if these references could be combined by one skilled in the art, the result would not be the ink composition of the present invention but instead would be an ink composition comprising the non-modified colored pigments of Yu et al. and the salts of Lin. Lin teaches that the salts having polyvalent ions exhibit a high degree of ionization in aqueous inks and help avoid intercolor bleed when the ink is printed next to, for example, a pigment based ink that is stabilized by an anionic dispersant (column 14, lines 56-62). This is due to the interaction of the disclosed ink, which has the polyvalent ion, and the anionic dispersant of the second ink. Furthermore, Lin teaches that it is desirable for the mult-valent metal salts to be compatible with

the components of the ink, including the pigment, and are chosen so that they will not cause latency or jetting problems (column 15, lines 17-24). One skilled in the art, in considering this teaching of Lin, would therefore not use a salt having a polyvalent ion to an ink composition having a modified colored pigment, as in Yu et al., since it would be expected that destabilization of the ink would occur. This is further supported by the disclosure of the present invention (see paragraph [0046]) in which it is described that flocculation of the pigment can result when the salt having a polyvalent ion is added to a modified pigment. The addition of a polymer is then found to redisperse the pigment, but this could only have been learned through hindsight.

Thus, while one skilled in the art may consider using a salt having a polyvalent ion in an ink composition comprising non-modified colored pigments, based on the teaching of Lin, one would not be motivated to use these salts in an ink composition comprising the modified colored pigments taught in Yu et al.

Also, claim 1 further recites that the functional group is capable of coordinating with the polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion. There is no teaching in Lin that the polyvalent ion coordinates with any functional groups, especially any within the same ink composition. Only interactions with other inks are disclosed (for bleed control). Additionally, there is no teaching or suggestion in Lin that specific salts having polyvalent ion should be used in combination with any specific materials. Only with the use of hindsight would one choose to combine a modified pigment having an anionic functional group in combination with a salt having a polyvalent cation or a modified pigment having a cationic functional group in combination with a salt having a polyvalent anion. Therefore, even if these references are combined, the result would not be the ink composition of the present invention.

Applicant therefore believes that claim 1 is patentable over Yu et al. in view of Lin. Furthermore, claims 2, 4-9, 11-12, and 14-25, which depend either directly or indirectly from claim 1, recite further embodiments of the present invention and, for at least the reasons discussed above, are also patentable over these references.

Regarding claims 27-30, claim 27 as amended relates to a method of generating an image comprising the steps of: 1) incorporating into a printing apparatus an ink composition comprising a liquid vehicle, at least one modified pigment comprising a pigment having attached at least one functional group, at least one salt with a polyvalent ion, and at least one polymer, and 2) generating an image on a substrate, wherein said functional group is capable of coordinating with said polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion. This claim therefore relates to an image generating method using the ink composition of claim 1. Since Applicant believes claim 1 is not obvious based on Yu et al. in view of Lin, the method of generating image of claim 27 is also not obvious based on these references.

Applicant therefore believes that claim 27 is patentable over Yu et al. in view of Lin. Furthermore, claims 28 and 30, which depend directly from claim 27, recite further embodiments of the present invention and, for at least the reasons discussed above, are also patentable over these reference.

Therefore, Applicant believes that claims 1-10 and 13-30 are patentable over Yu et al. in view of Lin and respectfully requests that this rejection be withdrawn.

Claims 1-2, 4-9, 11-17, 21-25, 27-28, and 30

The Examiner has rejected the above-identified claims as being unpatentable over Zhu (U.S. Patent No. 5,889,083) in view of WO 96/18596. Applicant respectfully disagrees.

In paragraph 10 of the Office Action, the Examiner states that Zhu discloses ink jet inks comprising an aqueous liquid vehicle, a modified pigment such as carbon black and cyan, magenta, and yellow, and a polymer such as styrene-acrylate copolymer, acrylic copolymer, and acrylic acid-(meth)acrylate copolymer, and a salt having a polyvalent metal cation such as calcium. The Examiner further states that a method wherein the above ink is incorporated into an ink jet printer and then printed onto a substrate is also disclosed. The Examiner concludes that, although there is no disclosure that the functional groups of the polymer is capable of coordinating with the polyvalent ion, given that Zhu The Examiner also states that, while Zhu discloses salts comprising

polyvalent ions identical to that presently claimed and polymer comprising functional groups identical to that presently claimed, it is clear that the functional group of the polymer is intrinsically capable of coordinating with the polyvalent ion. The Examiner further states that, while Zhu does not disclose the requirement of a modified pigment, WO 96/18596, which is drawn to ink jet inks, discloses modified pigments comprising a pigment such as carbon black having attached functional groups including ammonium, sulfonate, and carboxyl groups. The Examiner then concludes that, although there is no disclosure that either the functional group present on the pigment as disclosed in WO 96/18695 is capable of coordinating with the polyvalent ion of the salt as disclosed by Zhu, given that WO 96/18695 discloses pigments having attached functional groups identical to that presently claimed and Zhu discloses salts comprising polyvalent ions identical to that presently claimed, it is clear that the functional group of the pigment is intrinsically capable of coordinating with the polyvalent ion. Therefore, in light of the motivation for using a modified pigment disclosed by Wo 96/18695 as described above, the Examiner concludes it would have been obvious to one of ordinary skill in the art to use such a pigment in the ink jet ink of Zhu in order to produce an ink which does not require a dispersant and thereby arrive at the claimed invention.

Regarding claims 1-2, 4-9, 11-17, and 21-25, claim 1 relates to an ink composition comprising a) a liquid vehicle, b) at least one modified pigment comprising a pigment having attached at least one functional group, c) at least one salt having a polyvalent ion, and d) at least one polymer. The functional group is capable of coordinating with the polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion. -

Zhu discloses an aqueous jet ink composition comprising water, a colorant, a binder resin, and a wax, as well as a process for preparing and printing this ink. An example of the colorant is carbon black, and an example of a binder resin is a styrene-acrylic copolymer. Zhu further teaches that the jet ink compositions may also comprise a conductivity agent. Various salts for this purpose are disclosed, including calcium chloride. However, there is no teaching in Zhu of an ink composition comprising a modified pigment having attached at least one organic group. Only conventional pigments are disclosed.

WO 96/18695 discloses an aqueous ink jet ink comprising an aqueous vehicle and a modified carbon product comprising carbon having attached at least one organic group. The organic group comprises at least one ionic or ionizable group. A variety of additives, including polymers having functional groups, may be added (see page 8, line 13 to page 9, line 27). However, there is no teaching or suggestion of the use of a salt having a polyvalent ion in combination with a polymer and a modified carbon product.

Since Zhu relates to ink compositions comprising conventional pigments while WO 96/18695 relates to ink compositions comprising modified pigments, Applicant believes that these references would not be combined by one skilled in the art. These references deal with very different types of pigments. One skilled in the art, in considering the teaching of Zhu, would therefore not use a modified pigment having an attached organic group in an ink composition having a polyvalent metal cation, as in Zhu, since it would be expected that destabilization of the ink would occur. This is further supported by the disclosure of the present invention (see paragraph [0046]) in which it is described that flocculation of the pigment can result when the salt having a polyvalent ion is added to a modified pigment. The addition of a polymer is then found to redisperse the pigment, but this could only have been learned through hindsight.

Also, claim 1 further recites that the functional group is capable of coordinating with the polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion. There is no teaching in Zhu that the polyvalent ion coordinates with any functional groups, especially any within the same ink composition. Additionally, there is no teaching or suggestion in Zhu that specific salts having polyvalent ions should be used in combination with any specific materials. Only with the use of hindsight would one choose to combine a modified pigment having an anionic functional group in combination with a salt having a polyvalent cation or a modified pigment having a cationic functional group in combination with a salt having a polyvalent anion. Therefore, even if these references are combined, the result would not be the ink composition of the present invention.

Applicant therefore believes that claim 1 is patentable over Zhu in view of WO 96/18596. Furthermore, claims 2, 4-9, 11-12, and 14-25, which depend either directly or indirectly from claim 1, recite further embodiments of the present invention and, for at least the reasons discussed above, are also patentable over these references.

Regarding claims 27-28 and 30, claim 27 as amended relates to a method of generating an image comprising the steps of: 1) incorporating into a printing apparatus an ink composition comprising a liquid vehicle, at least one modified pigment comprising a pigment having attached at least one functional group, at least one salt with a polyvalent ion, and at least one polymer, and 2) generating an image on a substrate, wherein said functional group is capable of coordinating with said polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion. This claim therefore relates to an image generating method using the ink composition of claim 1. Since Applicant believes claim 1 is not obvious based on Zhu in view of WO 96/18596, the method of generating image of claim 27 is also not obvious based on these references.

Applicant therefore believes that claim 27 is patentable over Zhu in view of WO 96/18596. Furthermore, claims 28 and 30, which depend directly from claim 27, recite further embodiments of the present invention and, for at least the reasons discussed above, are also patentable over these reference.

Therefore, Applicant believes that claims 1-2, 4-9, 11-17, 21-25, 27-28, and 30 are patentable over Zhu in view of WO 96/18596 and respectfully requests that this rejection be withdrawn.

Claims 18-20

The Examiner has rejected the above-identified claims as being unpatentable over Zhu (U.S. Patent No. 5,889,083) in view of WO 96/18596, as applied to claims 1-2, 4-9, 11-17, 21-25, 27-28, and 30 above, and further in view of Lin (U.S. Patent No. 5,997,623). Applicant respectfully disagrees.

In paragraph 11 of the Office Action, the Examiner states that, while Zhu in view of WO 96/18596 does not disclose the requirement of a specific types of salts, Lin which is drawn to ink jet inks, discloses using a salt comprising a polyvalent metal cation such as zinc and a polyvalent anion such as sulfate in order to produce an ink with conductivity suitable for ink jet printing. The Examiner further states that Lin also discloses the equivalence and interchangeability of such salts with calcium chloride, as disclosed by Zhu. The Examiner concludes that, in light of the motivation for using a salt disclosed by Lin as described above, it would have been obvious to one of ordinary skill in the art to use such salts as the salt in Zhu, thereby arriving at the claimed invention.

Claims 18-20 depend directly from claim 1, which relates to an ink composition comprising a) a liquid vehicle, b) at least one modified pigment comprising a pigment having attached at least one functional group, c) at least one salt having a polyvalent ion, and d) at least one polymer. The functional group is capable of coordinating with the polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion.

As discussed in more detail above, since Zhu relates to ink compositions comprising conventional pigments while WO 96/18695 relates to ink compositions comprising modified pigments, Applicant believes that these references would not be combined by one skilled in the art. One skilled in the art, in considering the teaching of Zhu, would therefore not use a modified pigment having an attached organic group in an ink composition having a polyvalent metal cation, as in Zhu, since it would be expected that destabilization of the ink would occur.

Also, claim 1 further recites that the functional group is capable of coordinating with the polyvalent ion and is anionic when the salt comprises a polyvalent cation or is cationic when the salt comprises a polyvalent anion. There is no teaching in Zhu that the polyvalent ion coordinates with any functional groups, especially any within the same ink composition. Additionally, there is no teaching or suggestion in Zhu that specific salts having polyvalent ions should be used in combination with any specific materials. Only with the use of hindsight would one choose to combine a modified pigment having an anionic functional group in combination with a salt having

a polyvalent cation or a modified pigment having a cationic functional group in combination with a salt having a polyvalent anion. Therefore, even if these references are combined, the result would not be the ink composition of the present invention.

Lin does not cure the deficiencies of Zhu in view of WO 96/18596. As discussed in more detail above, while Lin discloses an aqueous ink jet ink comprising water, a colorant such as a dye or a pigment, and a diol derivative having a specified formula, there is also no teaching in Lin of an ink composition comprising a modified pigment having attached at least one organic group. Only conventional pigments are disclosed. Therefore, one skilled in the art, in considering the teaching of Lin, would also not use a salt having a polyvalent ion in an ink composition having a modified pigment, as in WO 96/18695, since it would be expected that destabilization of the ink would occur, regardless of the equivalence and interchangeability of the salts presumed by the Examiner. Furthermore, there is no teaching in Lin that the polyvalent ion coordinates with any functional groups, especially any within the same ink composition, nor is there any teaching or suggestion in Lin that specific salts having polyvalent ions should be used in combination with any specific materials. Only with the use of hindsight would one choose to combine a modified pigment having an anionic functional group in combination with a salt having a polyvalent cation or a modified pigment having a cationic functional group in combination with a salt having a polyvalent anion. Therefore, even if these references are combined, the result would not be the ink composition of the present invention.

Therefore, Applicant believes that claims 18-20 are patentable over Zhu in view of WO 96/18596 and further in view of Lin, and respectfully requests that this rejection be withdrawn.


Conclusion

In view of the foregoing remarks, Applicant believes that this application is considered to be in good and proper form for allowance, and the Examiner is respectfully requested to pass this application to issue. If, in the opinion of the Examiner, a telephone conference would further

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expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

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